DOCUMENT RESUME

ED 465 336 HE 034 986

AUTHOR Ruban, Lilia; McCoach, D. Betsy; Nora, Amaury
TITLE The Differential Impact of Pre-College and Self-Regulatory Factors on Academic Achievement of University Students with and without Learning Disabilities.
PUB DATE 2002-04-00
NOTE 51p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 1-5, 2002).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Academic Achievement; Aptitude Tests; College Preparation; Grade Point Average; Higher Education; *Learning Disabilities; Models; Prediction; *Student Characteristics; *Undergraduate Students
IDENTIFIERS *Self Regulation

ABSTRACT

Even though research on academic self-regulation has proliferated in recent years, no studies have investigated the question of whether the perceived usefulness and the use of standard self-regulated learning strategies and compensation strategies provide a differential prediction of academic achievement for college students with and without learning disabilities (LD), after controlling for standardized aptitude measures (such as the Scholastic Assessment Test) and academic level in college. This study reports the development and testing of a model explaining the interrelationships among aptitude measures, self-regulatory variables, and grade point average using structural equation modeling and multiple groups analysis for students with LD (n=53) and students without LD (n=417). Data were gathered using a new instrument survey entitled "Learning Strategies and Social Skills" (Ruban and Reis, 1999). The results indicate that students with LD differed significantly from students without LD in the relationships among standardized aptitude measures, academic level, and the use of standard self-regulated learning strategies and compensation strategies, which, in turn, provided a differential explanation of academic achievement for students with and without LD. These paths of influence and idiosyncrasies of academic self-regulation among students with LD are interpreted in terms of social cognitive theory and research conducted in the field of learning disabilities. (Contains 4 figures, 3 tables, and 79 references.) (SLD)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 465 336

The Differential Impact of Pre-College and Self-Regulatory Factors on Academic Achievement of University Students with and Without Learning Disabilities

Lilia Ruban
University of Houston

D. Betsy McCoach
University of Connecticut

Amaury Nora
University of Houston

L Ruban

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Paper presented at the distinguished paper session at the annual convention of the American Educational Research Association, New Orleans, Louisiana, April 2002. All correspondence regarding this paper should be addressed to: Lilia M. Ruban, University of Houston, Department of Curriculum & Instruction, 256 Farish Hall, Houston, TX 77204-5027, Phone: 713-743-3311; e-mail: Lruban@UH.EDU.

HE034980

BEST COPY AVAILABLE

Acknowledgements

This manuscript is based in part on a dissertation submitted in partial completion of the requirements for a doctoral degree in the Neag Graduate School of Education at the University of Connecticut. I want to thank the members of my doctoral Committee, including Sally Reis, Joseph Renzulli, Joan McGuire, Robert Gable, and David Kenny for their help and feedback during the completion of this research.

Abstract

Even though research on academic self-regulation has proliferated in recent years, no studies have investigated the question of whether the perceived usefulness and the use of standard self-regulated learning strategies and compensation strategies provides a differential prediction of academic achievement for college students with and without learning disabilities (LD), after controlling for standardized aptitude measures (such as the SAT, or Scholastic Assessment Test) and academic level in college. This study reports the development and testing of a model explaining interrelationships among aptitude measures, self-regulatory variables and GPA using structural equation modeling and multiple groups analysis for students with learning disabilities (n=53) and students without learning disabilities (n=417). Data were gathered using a new instrument entitled *Learning Strategies and Study Skills* survey (LSSS, Ruban & Reis, 1999). The results of this study indicate that students with LD differed significantly from students without LD in the relationships between standardized aptitude measures, academic level, and the use of standard self-regulated learning strategies and compensation strategies, which, in turn, provided a differential explanation of academic achievement for students with and without LD. These paths of influence and idiosyncrasies of academic self-regulation among students with LD were interpreted in terms of social cognitive theory and research conducted in the field of learning disabilities.

The Differential Impact of Pre-College and Self-Regulatory Factors on Academic Achievement of College Students with and Without Learning Disabilities

Theoretical Framework

Academic Self-Regulation: An Overview

Menges and Swinicki (1995) contended that self-regulated learning is "an emerging area of scholarship that holds singular importance for postsecondary education: the capacity of students to regulate their own learning" (p. 1). Studies conducted within the self-regulated learning framework that have previously focused on research on student performance and achievement in K-12 settings are now being supplemented by research with college students (Pintrich, 1995; Zimmerman & Paulsen, 1995). Researchers have found a strong relationship between students' use of self-regulated learning strategies and their academic achievement (Alexander & Judy, 1988; Pintrich & De Groot, 1990; Zimmerman, 1989; Zimmerman & Martinez-Pons, 1986, 1988). In particular, Pintrich and De Groot (1990) found that students who reported greater self-regulatory strategy use also reported higher levels of academic self-efficacy, intrinsic motivation, and academic attainment. In a review of several recent studies, Schunk and Zimmerman (1994) concluded that self-regulated learners are likely to have more adaptive cognitive, motivational, and achievement outcomes than their peers who fail to self-regulate. More generally, models of self-regulated learning provide a very useful description of what effective learners do to succeed academically in college (Pressley & McGormick, 1995).

An emerging trend at all levels of education eschews overreliance on standardized measures of aptitude and achievement and ascribes more importance to self-regulated learning variables in explaining academic and professional success (Barron & Norman, 1992). Such a trend is of particular importance for postsecondary students with learning disabilities (LD). Previous studies found that, generally, college students with LD enter college less academically prepared than their non-disabled peers, they perform more poorly on the SAT, and they achieve at lower levels than their peers in college; however, they graduate at about the same rate and within the same time frame (McGuire & Madaus, 1999; Vogel & Adelman, 1992). Challenging university settings place increased demands on student autonomy and independence and require more self-regulation on the part of students with LD (Crux, 1991; Hodge & Preston-Sabin, 1997). As a consequence, academic self-regulation has emerged as a key variable explaining academic and professional success for students with learning disabilities (Barga,

1996; Brinckerhoff, McGuire, & Shaw, 2002; Gerber, Ginsberg, & Reiff, 1992; Reis, McGuire, & Neu, 2000).

Types of Self-Regulated Learning Strategies: A Debated Issue

Even though there is substantial research on operationalizing and measuring academic self-regulation, differences in views on the construct among researchers may have implications for interventions with disabled and non-disabled student populations. According to Zimmerman and Paulsen (1995), some investigators treat self-regulation as an idiosyncratic set of skills that students use in their academic work. In particular, Crux (1991) explained that each student with LD must develop individual compensation strategies as he or she goes through school. Other investigators assume that a common set of standard self-regulatory learning skills exists and is used by the general population of students (Pintrich & Garcia, 1991; Zimmerman, 1989). Both groups of researchers agree that these skills are highly predictive of student academic success, and that these skills can be taught. Existing instruments measure primarily standard self-regulated learning strategies used by secondary and postsecondary students (e.g., Pintrich, Smith, Garcia, & McKeachie, 1993; Weinstein, Zimmerman, & Palmer, 1988; Zimmerman & Martinez-Pons, 1986, 1988).

However, a question remains whether the academic self-regulatory processes used by students with and without LD are similar, or whether self-regulation has its own idiosyncrasies when applied to students with learning disabilities. A related issue is a question of the perceived usefulness or utility of standard self-regulated learning strategies and compensation strategies for college students with and without LD. Since students' perceptions about the usefulness of learning strategies may represent a proxy for determining their motivation to use such self-regulatory methods, a clearer understanding of the role such perceptions may play in the learning process may have implications for interventions. In addition, the recent debate about the validity and predictive power of test scores obtained from the examinees with disabilities (including learning disabilities) taking standardized tests with accommodations has raised legal, psychometric, and social policy issues (Royer & Pitoniak, 2001). It remains unclear whether the patterns of the interrelationships among standardized aptitude measures, academic level, motivation, student use of self-regulated learning strategies, and academic achievement differ for students with and without learning disabilities.

Standard Self-Regulated Learning Strategies. A major component of academic self-regulation is self-regulated learning strategies defined by Zimmerman (1989) as "actions and processes directed at acquiring information or skills that involve agency, purpose, and instrumentality perceptions by the

learners" (p. 329). Zimmerman and Martinez-Pons (1986), using interviews with high school students, found evidence of 14 types of self-regulated learning strategies including such methods as organizing and transforming information, self-consequating, seeking information, and rehearsing and using memory aids. Students' use of these strategies was highly correlated with their achievement and with teachers' ratings of their self-regulation in a class setting. In fact, students' reports of their use of these self-regulated learning strategies predicted their achievement track in school with 93% accuracy, and 13 of the 14 strategies discriminated significantly between students from the upper achievement track and students from lower tracks. The self-regulated learning strategies described by Zimmerman (1989) encompass three classes of strategies that all students use to improve self-regulation of their (a) personal functioning; (b) academic behavioral performance; and (c) learning environment (Bandura, 1986; Zimmerman, 1989).

Learning Strategies as Compensations For Disabilities. Crux (1991), in her practical guide on learning strategies for adults with LD, explained the importance of compensation strategies for postsecondary students with LD. According to her, before learners can compensate for weaknesses, they first must be aware of what they do poorly. When they know this, they must be prepared to analyze what goes wrong and where the breakdown occurs. With that information, alternative approaches, or methods to compensate for learning deficits, can be considered. In a qualitative study, Reis and her colleagues provided a comprehensive discussion of specific compensation strategies that were critical in the academic success of students with LD in a challenging postsecondary setting (Reis et al., 2000). Compensation strategies included "study strategies, cognitive/learning strategies, environmental accommodations, opportunities for counseling, self-advocacy, and the development of an individual plan incorporating a focus on metacognition and executive functions" (p. 124). Reis et al. (2000) emphasized that these university students with LD attributed their success in their academic pursuits to their ability to use compensation strategies, such as study and management skills including note taking, use of daily, weekly, and monthly calendars, and identifying key points when studying written material. Compensatory learning supports used by these students included books on tape to accompany text material, computer programs to help organize written reports, tape recordings as a supplement to lecture material, and spelling aids (e.g., Franklin speller). Subjects in the study also reported using planning techniques, such as time management, metacognition, and setting work priorities. Additional strategies included taking a reduced load of courses, requesting extended time for examinations, taking an exam using a computer, and requesting extra help from professors. In sum, Reis and her colleagues found that high ability students with learning disabilities in their study were able to succeed in a challenging

university environment with the help of various compensation strategies, including some that were different from those self-regulated learning strategies identified by Zimmerman (1989).

Motivation and Academic Self-Regulation

Students' Regulation of their Motivation. In addition to monitoring and controlling cognitive and metacognitive strategies, self-regulated learners also actively manage other important aspects of their classroom learning (Wolters, 1998). In particular, in the social cognitive theory of academic self-regulation, students regulate the motivational, affective, and social determinants of their intellectual functioning as well as the cognitive aspects (Zimmerman, 1986; 1990; Zimmerman & Bandura, 1994). For example, motivation, characterized as a student's willingness or desire to be engaged and commit effort to completing a task, is an important component of classroom learning that students may self-regulate (Wolters, 1998). Pintrich and Schrauben (1992) explained that in behavioral terms, motivation is indicated by a student's choice to engage in a particular activity and the intensity of his or her effort and persistence for that activity. As a consequence, self-regulated students are generally regarded as highly motivated students because they exhibit greater levels of engagement, effort and persistence for learning tasks than their peers who do not self-regulate (Zimmerman, 1989, 1990). As Zimmerman and Bandura (1994) contended, "it is one thing to possess self-regulatory skills but another thing to be able to get oneself to apply them persistently in the face of difficulties, stressors, or competing attractions" (p. 846). Zimmerman and Bandura also pointed out that this motivational aspect of self-regulated learning, which plays a central role in mobilizing, directing, and sustaining one's learning efforts has received relatively little attention in studies of academic self-regulation.

Motivation in Using Self-Regulated Learning Strategies as a Function of their Utility. Utility in the context of this investigation encompassed several issues. First, personal utility refers to students' personal and informal assessment of the usefulness of a particular learning strategy or method in their own academic work. Simply put, if students do not find ways to internalize a particular learning strategy and apply it consistently in their courses, they will not use it (Garner, 1990; Nolen & Flaladyna, 1990). Deborah Butler, the developer of the *Strategic Content Learning* (SCL) approach for college students with learning disabilities (Butler, 1998; Butler, Elaschuk, & Poole, 2000) contended that in order for students to self-regulate their academic behaviors effectively, they need instructional assistance in developing personalized strategies, which build on their strength and help them compensate for their learning difficulties, and which are applicable in contexts that are immediately meaningful to them. This idea links to the idiosyncrasies of academic self-regulation of college students with LD, and the

utility function of self-regulated learning strategies as applied across different learning contexts. Another aspect of the utility of learning strategies relates to the generalizability of these strategies across settings. It appears that certain kinds of learning strategies may be useful in school settings, but may have limited generalizability beyond academic settings. For example, the use of routine memorization may help some students get good grades in certain courses, but it may turn out to be of limited practical utility to them in professional or authentic settings that may place more emphasis on creative and critical thinking abilities, and problem solving (see, for example, Zimmerman, 1998).

Academic Level, Students' Regulation of Their Learning, and Achievement in College

Previous research supports the existence of positive relationship between college students' academic level and their academic achievement (e.g., Van Etten, Pressley, & Freebern, 1999; Vermetten, Vermunt, & Lodewijks, 1999). Several esearchers who conducted longitudinal, within-subjects studies (e.g., Vermetten et al., 1999) have formulated a *developmental hypothesis*, meaning that, as students progress through academic levels in college, their learning strategies, mental learning models, and learning orientations become more complex and more focused, and reveal stronger relationship to their academic achievement. Vermetten et al. (1999) in their longitudinal study of college students found that students as a group improved their reported quality of learning within the first few years of a university study, as evidenced in the considerable changes in their reported use of learning strategies. In particular, students reported greater use of strategies representative of a meaning-directed learning style. Notably, several cross-sectional studies conducted by other researchers (e.g., Busato, Prins, Elshout & Hamaker, 1998; Lonka & Lindblom-Ylänne, 1996) did not detect differences in learning style dimensions in a cross-sectional design, but found an increase in reported use of meaning-directed learning style in a longitudinal design (Vermetten et al., 1999). Watkins and Hattie (1985) also reported significant positive changes in the use of self-regulated learning strategies in a longitudinal study. Vermetten et al. explained that, from the perspective of higher education, which aims at generating more advanced and deep-level learners who are self-regulating, these results are very satisfying. As stated above, accumulated research evidence supports a strong positive relationship between students' use of self-regulated learning strategies and their academic achievement (Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1986, 1988). Synthesis of literature on self-regulated learning strategies within a general framework of methodological and conceptual issues is graphically represented in Figure 1.

Traditional Prediction of College Achievement Using Standardized Tests

Prediction of academic achievement has been a pervasive topic in American education. Proliferation of research studies conducted within this paradigm have proposed a large number of variables which can potentially explain academic achievement in K-12 and postsecondary settings. Particularly, a general proclivity for using various standardized measures has resulted in overreliance on the SAT and the ACT standardized scores in predicting academic attainment in college (e.g., Wilson, 1983). Naumann (1998) pointed out that the validity of academic assessment inevitably becomes an essential issue when educational measures are used in "high stakes" test environments where the decision-making process may have a long-term impact on an individual's life. For instance, the results of such tests have serious implications for persons trying to secure a particular job, qualify for certain educational programs or attain admittance into college. She contended that it is unreasonable for measurement specialists or college admission personnel to be satisfied with a scale that is able to predict only 15-20% of the variance in college performance. The researcher cited several studies that examined the amount of variance in academic performance that these tests are able to explain. For example, the average amount of variance in the first-year grade-point average explained by the SAT or the ACT is only 25%, with most studies reporting values slightly above 10% (Linn, 1990). These values remain fairly stable when cumulative grade point average after four year of college is used as a criterion variable (Wilson, 1983). In contrast, these values decrease dramatically when high school grade point average or class ranks are added into the prediction equation (Neisser et al., 1996).

In addition, using a large sample of college students, Baron and Norman (1992) found that the SAT scores were able to provide extremely small incremental validity, adding only about 4% increase (i.e., very small effect size according to Cohen's 1988 guidelines) in the prediction of the variance in the cumulative GPA after four years of college above and beyond the amount predicted by high school grade point average. Crouse and Trusheim (1988) supported these findings, providing evidence that high school grade point average may be a better predictor of college GPA, and that the SAT does not provide significant incremental validity to the prediction, after controlling for the effects of high school rank. Furthermore, research conducted within the social cognitive theory framework questions the predictive power of standardized aptitude measures in predicting college attainment. For example, Zimmerman and Bandura (1994) examined the impact of self-regulatory influences on writing course attainment in a selective postsecondary institution. They found that students' verbal aptitude (i.e., SAT-Verbal scores) did not have any direct impact on course grades when self-regulatory factors were included. Verbal aptitude affected writing course outcomes only indirectly by its influence on self-

evaluative standards and personal goal setting. Importantly, the self-regulatory factors in the path model not only mediated the influence of verbal aptitude but also provided an incremental contribution of 29% in the prediction of the final grades in the writing course.

Issues of Predictive Validity of Standardized Aptitude Measures and Academic Achievement of College Students with Learning Disabilities

In recent years, there has been a trend for increased diversity in the student body in colleges and universities (Henderson, 1999; Brinckerhoff, McGuire, & Shaw, 2002). For example, increasing numbers of nontraditional students, i.e., adult students and students with learning disabilities (LD) are enrolling in postsecondary institutions (Henderson, 1999; *Student Support Services*, 1992). According to *The American Council on Education* (Henderson, 1999), students with learning disabilities have continued to be the fastest growing disability group in college. In fact, the percentage of first time, full time freshman with disabilities reporting this condition increased from 25% in 1991 to 41% in 1998. Specifically, in 1998, students with LD represented 3.7% (i.e., 5,717) of the total college population. Learning disabilities (LDs) have been defined as "disorder(s) in one or more of the basic psychological processes involved in understanding or using language … [possibly] manifest[ing themselves] in imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations (1996 U.S. Department of Education guidelines, cited in Harvard Law Review Association, 1998, p. 1560). Within the traditionally used discrepancy view framework, diagnosis of a learning disability is typically made by comparing the level of obtained achievement with that predicted by the individual's level of intelligence (Gresham, Macmillan, & Bocian, 1996). Students with LD ordinarily face additional obstacles in academic settings because of their learning difficulties (Shin, 1998). Due to the provision of special services to individuals with disabilities mandated by the legislation (e.g., Individuals with Disabilities Act [IDEA], 1991, 1997), students with learning disabilities are now progressing farther in school and are more likely to reach the point at which they are taking admission and licensing examinations (Phillips, 1994). Individuals with disabilities (including learning disabilities) are entitled to receiving accommodations when taking standardized tests such as the SAT and the ACT (Wightman, 1993), examinees with LD representing the plurality (90%) of all examinees with disabilities. Common accommodations for students with LD include the use of extended time, use of a cassette and regular-type, or large-type edition of the test, and the use of word processors (Bennett, Ragosta, & Stricker, 1988; McGuire, 1998).

As a consequence, the issue of providing accommodations and the validity of scores obtained from the examinees taking standardized tests with accommodations has become a widely debated issue in the field of learning disabilities (Bennett et al., 1988; Braun, Ragosta, & Kaplan, 1988). In their comprehensive review of psychometric, legal, and social policy issues relating to testing accommodations for examinees with disabilities, Pitoniak and Royer (2001) described these issues as "thorny ones" (p. 93). As evidence of the nature of difficulties associated with establishing evidence of predictive validity of scores received by examinees with disabilities under accommodated conditions, they cited several studies conducted with college applicants (e.g., Bennett et al., 1988; Braun et al., 1988; Wightman, 1993). In particular, Pitoniak and Royer (2001) drew attention to the findings from a comprehensive ETS/CB/GREAB research project, in which Braun et al. (1988) examined the degree to which the test predicted the academic performance of students with and without handicaps in college and graduate school. An important finding from the SAT study was that standardized scores significantly overpredicted college academic attainment for examinees with disabilities receiving test accommodations. This finding applied for examinees with learning disabilities who achieved relatively high scores, namely, their performance was overpredicted by more that half a standard deviation. Braun et al. (1988) linked this overprediction to the provision of extra time for these candidates and substantiated their claim with their finding that the highest-scoring students in this group also took the longest amount of time to complete the test. They concluded that the amount of extra time provided for these individuals needs to be better matched to the type of disability supported by empirical evidence, in order to avoid circumstances in which accommodations may overcompensate for disability.

A notable outcome from the research on testing accommodations is an emerging interest in examining compensatory skills used by individuals with disabilities (e.g., Geisinger, 1994; Phillips, 1994), and, in particular, the identification of varied compensation strategies systematically used by students with learning disabilities in order to compensate for their learning difficulties. This new avenue for research links to the importance of considering self-regulated learning variables in explaining academic attainment for students with and without learning disabilities.

A Call for a Paradigm Shift in Our Views of Learners

In summary, the debate about the merits and liabilities of standardized achievement measures such as the ACT and the SAT (Crouse & Trusheim, 1988; Wilson, 1983) has resulted in attempts to improve prediction of academic achievement of college students and to explain adult professional success by assessing the impact of academic self-regulation of student learning (Vogel & Adelman,

1992, 1993; Butler et al., 2000; Schunk & Zimmerman, 1998). As evidenced by findings from a number of empirical studies, standardized measures have limited predictive power. Further, Reiff, Hatzes, Bramel and Gibbon (2001) asserted that traditional constructs and measures of intelligence often have little to do with later success in life. In their review of literature on the importance of emotional intelligence for college students with LD, the authors argued that high grades in college do not predict professional success, productivity, or life satisfaction (Ekman, 1992; Sutarso, Baggert, Sutarso, & Tapia, 1996). This idea has profound implications for learning and teaching. It appears that the emerging trend at all levels of education is to move away from overreliance on standardized aptitude and achievement measures, toward ascribing more importance to self-regulated learning variables to explain and predict students' academic attainment and adult professional success.

This study examined the relationships among standardized aptitude measures (the SAT, or the Scholastic Assessment Test), academic level, motivation, self-reported use of academic self-regulatory methods and academic achievement among university students with and without learning disabilities using structural equation modeling procedures. This approach provided a comprehensive view of the interrelationships among the variables viewed as important determinants in student learning and academic achievement. Furthermore, we examined simultaneously the differential impact of these variables on the academic achievement of students with and without LD using multiple groups analysis. Differences in relationships between the impact of the SAT, students' metacognitive self-appraisal of the utility of academic self-regulatory methods (i.e., their motivation in using learning strategies), the use of these methods, and academic performance may increase our understanding of the nature of academic self-regulation in these different groups of students. Identifying differences in the strength and direction of relationships among standard self-regulated learning variables and compensation strategies and GPA for students with and without LD may provide insights about idiosyncrasies of academic self-regulation when it is applied to college students with LD. Such understanding may provide implications for service providers who must help students with LD become independent learners and succeed academically in a challenging university environment. The research questions examined in this study included:

1. What is the relationship between standardized aptitude measures, academic level, motivation, the use of self-regulated learning strategies and compensation strategies, and academic achievement of university students?

2. Is there a differential impact of the standardized aptitude measures, academic level, motivation, the use of standard self-regulated learning strategies and compensation strategies on the academic achievement of university students with and without learning disabilities?

Methods and Procedures

Research Design

In this study survey research methods were utilized. Survey research design, a form of descriptive research, provided an overarching framework for this investigation, which was conducted in a higher educational setting (Light, Singer, & Willett, 1990). Survey research methods were used to gather data about demographic characteristics, study practices, and student self-reported use of self-regulated learning strategies and study skills among university students. University electronic database was used to gather data about SAT scores.

Sample

The sample in this survey research study included two groups of undergraduate students from a large research university in the northeast (N=470), students without learning disabilities (n=417) and students with learning disabilities (n=53). The demographic and academic characteristics of the sample are presented in greater detail in Table 1.

Students without Learning Disabilities (LD). One-third of the students in the non-LD sample (n=417) were male (30.5%), with an average age of 20 years old. The majority of the students were Caucasian (75.5%) and they represented a variety of academic levels (freshman, 23.3%; sophomore, 29.7%; juniors, 30.7%; and seniors, 16.1%). Students' self-reported cumulative GPA ranged from an extremely low of .42 to a high of 4.00 (M = 3.03; SD = .83). Students SAT-Verbal scores ranged 370 – 800 (M = 604; SD = 98); their SAT-Math scores ranged 330 – 800 (M = 607; SD = 97).

Students with Learning Disabilities (LD). Two-fifths of the LD sample (n=53) were female (41.5%); the mean age of this group was 22 years old. The plurality of respondents were white (88.7%), and they tended to be mostly in the lower division (freshman, 34%; sophomore, 26.4%; juniors, 9.4%; only about a third of the students with LD were seniors, 29.4%). Their self-reported GPA ranged 1.70 – 3.80 (M = 2.77; SD = .58). Their SAT-Verbal scores ranged between 340 and 640, with a mean of 503 and standard deviation 71. Their SAT-Math scores had greater range (200 – 690) and variability (M = 524; SD = 93).

Instrumentation

A new 58-item instrument entitled *Learning Strategies and Study Skills Survey* (*LSSS*, Ruban & Reis, 1999) was developed for this study to assess students' self-reported use of self-regulated learning strategies and compensation strategies in their academic work across academic settings. This instrument was developed using Zimmerman's (Zimmerman, 1989; Zimmerman & Martinez-Pons, 1986, 1988) work on self-regulated learning strategies used by school students, and Reis, Neu, and McGuire's work on compensation strategies used by academically successful university students with learning disabilities (LD) (Reis, Neu, & McGuire, 1997; Reis et al., 2000). The first three factors corresponded to standard study skills and learning strategies used by a general population university students. The last three factors represented compensation strategies used primarily by students with LD. Alpha reliabilities on the six factors of the LSSS survey ranged from .70 to .92. The instrument utilized a five-point Likert summated ratings scale with only the end points labeled, from "1" = "*Not At All Typical of Me*" to "5" = "*Very Typical of Me*." Therefore, students' use of self-regulated learning strategies, as measured by the *LSSS*, is indicated along a continuum, as high scores indicate a more frequent use of learning strategies, and low scores suggest that a student generally does not use learning strategies in his or her academic work. For the purposes of this study, mean scale scores on the following three factors were used as self-regulated learning variables in the structural equation modeling analysis: Conceptual Skills, Routine Memorization, and Compensation Strategies. Table 2 presents students' mean scores on the self-regulated learning factors, type of learning strategies comprising the self-regulated learning factors, Chronbach alpha reliabilities, and goodness of fit summary indices for the confirmatory factor analysis.

Data Analyses

Confirmatory factor analysis (CFA) and structural equation modeling analysis (SEM) were used to assess psychometric properties of the *LSSS* survey, and to assess the extent of the differential impact of the standardized aptitude measures, academic level, perceived usefulness and the use of standard self-regulated learning strategies and compensation strategies on the academic achievement of university students with and without learning disabilities. Data analyses were conducted using EQS 5.7b program for Windows (Bentler & Wu, 1995). Descriptive statistics, Pearson's correlation and a two-sample independent t-test were used on selected demographic and academic variables.

Confirmatory Factor Analysis. Support for the construct validity of the instrument was obtained through the use of a confirmatory factor analysis (CFA), which permits an examination of the psychometric adequacy of an instrument and can aid in item evaluation and construct development

(Kenny, Kashy, & Bolger, 1998). The confirmatory factor analysis utilized a "model generation strategy" (McCallum, 1995) to improve fit to the data and achieve parsimony. The CFA analysis found sufficient support for the final measurement model. The final three-factor measurement model, consisting of 19 items, exhibited a significant chi-square, χ^2 (147) = 241.0, $p < .001$. In confirmatory factor analysis, a non-significant value in the chi-square test supports the hypothesized model, however, the likelihood of rejecting a true model increases with the use of large sample sizes (Marsh, Balla, & McDonald, 1988). Therefore, the results were interpreted based on the following fit indices: Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). The obtained results supported the existence of a three-factor structure on the LSSS survey (TLI = .95, CFI = .96, RMSEA = 0.037). The standardized loadings for the final measurement model were in the moderate to high range (.38 - .85), and all Cronbach alpha reliabilities were in the range recommended by Gable and Wolf (1993), i.e., .70 and above. (See Table 2) The correlations among the factors ranged from non-significant to moderate (.02 to -.37).

Omnibus Run and Multiple Groups Analysis. To examine relationships among standardized aptitude scores, academic level, motivation, conceptual skills, routine memorization skills, compensation strategies, and students' GPA, a structural equation model for the entire sample of students with and without learning disabilities (N = 470) was tested. Researchers assessed global fit of the structural model using the Tucker-Lewis index (TLI), the comparative fit index (CFI), and the root mean square approximation error (RMSEA). The TLI and CFI values above .90, in conjunction of RMSEA values below .05 indicate a good fit of the model. In addition, standardized residuals and modification indices were inspected for evidence of local fit. We also examined the differential effects of the three self-regulatory factors for college students with and without learning disabilities. A preliminary, exploratory multiple groups structural analysis was conducted to ascertain whether the structural model that was developed differed across these two groups of students. Because the sample of students with learning disabilities was so small, the analyses possessed inadequate power to statistically test the plausibility of imposing equality constraints across groups. However, a visual inspection of the standardized structural parameters and R^2 for the two groups revealed some interesting differences between the groups.

Measurement of Variables in the Model. The three factors (Conceptual Skills, Routine Memorization, and Compensation Strategies) represented latent variables in the structural equation model created in this study, with items serving as indicators. Students were also asked to report their cumulative grade point average (GPA) that served as the observed dependent variable in this study. The

latent variable Motivation was measured by combining two questions on the *Learning Strategies and Study Skills* survey. The first indicator was measured by a four-point Likert-type item, which asked students to rate the degree to which they consider the use of study skills and learning strategies to be beneficial in their work, from "1" = "*Not Beneficial*," to "4" = "*Very Beneficial*." The second indicator was measured by a composite variable comprised of ratings on seven dichotomized items, which asked students to indicate why they choose to use (1) or not to use (0) learning strategies and study skills in their academic work. The rationale for including this variable in the study was research indicating that students will be more motivated to use self-regulated learning strategies if they perceive that the strategies are useful in their academic work (Garner, 1990; Nolen & Flaladyna, 1990).

Procedure

Several data collection procedures were used in this study, in order to ensure the highest response rate and obtain accurate data. These strategies included mailed surveys, distribution of the surveys through the personnel working with the students in their respective programs (i.e., *The Honors Scholars Program, The University Program for College Students with Learning Disabilities*, and *The Scholastic Probation Program*), distribution of surveys in class, direct phone calls and e-mail messages to students. A cover letter and a post-paid return envelope, when appropriate, were sent along with a questionnaire. Students were offered incentives to participate in the study, namely, (a) the respondents' names were entered in a random *drawing* of gift certificates from the campus bookstore; and (b) students who filled out surveys in class were given extra credit. Students were assured of anonymity and that only the investigator would have access to the data. Students were asked to report their cumulative grade point average (GPA) on the survey, and this self-reported GPA was used as a measure of their academic achievement in college.

Results

Demographic and Academic Characteristics of the Sample of Students With and Without LD.

Students with LD (n=53) and students without LD (n=417) as a group differed on several demographic and academic characteristics. Students without LD had significantly higher scores on both SAT-Verbal [$t(434) = 6.62$, $p < .001$)] and SAT-Math scores [$t(434) = 5.31$, $p < .001$]. SAT-Verbal scores in the LD sample showed smaller variability ($M = 503.41$; $SD = 71$) than in the non-LD sample. Specifically, non-LD students' SAT-Verbal scores averaged 605, well above the national mean of 500.

with a standard deviation of 98, which is close to the national norm of 100. The two groups also differed on cumulative GPA [$t(468) = 2.31$, $p < .05$], with students without LD reporting on average higher GPAs. Students in both groups were asked to self-report both their current cumulative GPA and expected GPA at the end of the semester in which the survey was administered. Pearson's correlation between current and expected GPA for students with LD was $r = .89$ ($p < .0001$), with students reporting higher expected GPAs. Similarly, Pearson's correlation between current and expected GPA for students without LD was $r = .83$ ($p < .0001$); these students also reported higher expected GPAs.

Omnibus Run for the Entire Sample

In the hypothesized model, the SAT-V, SAT-M, and Academic Level predicted student motivation to use learning strategies, their use of standard SRL strategies and compensation strategies, which in turn predicted student academic achievement (GPA). First, the structural model was tested on the entire sample of students with results illustrated in Figure 2.

<Fig. 2 here>

The chi-square for this model was $\chi^2(262) = 491.698$, $p < .001$. Several statistically insignificant paths were dropped from the final model. Although the final chi-square was significant, this statistic is extremely sensitive to sample size (Kline, 1998). Therefore, a number of other measures of fit were examined. Both the comparative fit index (CFI) and the Tucker Lewis index (TLI) were above .90, and the root mean squared error of approximation (RMSEA) was below 0.05. Conventional practice in structural equation modeling suggests that values of CFI and TLI above .90 (Kline, 1998) and values of RMSEA below .05 (Maruyama, 1998) provide evidence of a good fitting model. Therefore, the fit indices indicated that the data provided adequate evidence of reasonable fit to the final specified model.

This omnibus model explained 61% of the variance in students' self-reported cumulative GPAs. Only one of the three self-regulated learning factors, the compensation strategies factor was a significant predictor of GPA. However, the path from compensation strategies to GPA was negative ($\beta = -.142$), suggesting that students who reported using more compensation strategies tended to have lower GPAs than students who reported using fewer compensation strategies. The motivation factor had a significant direct path to GPA ($\beta = .383$). This suggests that students who report perceiving greater benefits from using self-regulated learning strategies also tend to report having higher GPAs. Although motivation factor was a significant predictor of the memorization factor ($\beta = .27$), the direct path from the routine memorization factor to grade point average (GPA) failed to reach statistical significance at the .05 level. This finding suggests that self-reported use of memorization strategies is not related to GPA, after

controlling for the effects of the conceptual skills, compensation strategies, students' motivation, SAT-Verbal, SAT-Math, and academic level. In other words, after controlling for the other two self-regulated learning factors, motivation, and pre-college factors, an increase in the reported use of routine memorization strategies did not significantly affect the prediction of students' GPA. Therefore, the path was deleted from the final model. In addition, there was no direct path from the motivation factor to the compensation strategies factor. This suggests that the use of compensation strategies is essentially unrelated to the perceived usefulness of self-regulated learning strategies, as operationalized in this model. Academic level had direct significant paths to conceptual skills (ß = .114), compensatory strategies (ß = -.15), and GPA (ß = .184). In other words, older students reported having higher GPA's, using more conceptual skills and using fewer compensation strategies. Motivation mediated the effect of academic level on GPA, namely, students who have been in college longer and who have higher levels of motivation for using self-regulated learning strategies have higher GPAs. SAT-Math had the only significant direct path to GPA (ß = .264). The total effect of the SAT-V on GPA was .401; the total effect of academic level on GPA was .294.

Structural Model for Students without Learning Disabilities

It should be noted that we could not establish factorial invariance for the Motivation latent variable in the LD sample. Therefore, this variable was omitted from the final run in the multiple groups analysis. In the new structural model, exogenous variables academic level, SAT-Verbal, and SAT-Math had direct and indirect paths to GPA via the three self-regulated learning factors. The structural equation model for students without learning disabilities (see Figure 3) accounted for 38% of the variance in their self-reported cumulative GPAs. In contrast to the finding for students with learning disabilities (see below), there was a negative relationship between the use of compensation strategies and self-reported GPA for students in this group (ß = -.125), with students reporting greater use of these strategies also reporting lower GPAs. Even though the paths for the three self-regulated factors were statistically significant, none became the strongest predictor of GPA. The path from conceptual skills to GPA was ß = .143; the path from routine memorization to GPA was ß = .144. Unlike the model for students with learning disabilities, there was a significant path from the academic level to GPA, suggesting that students who had been in college longer reported having higher GPA's. The small negative path from academic level to GPA to the compensation strategies factor (ß = -.168) suggested that as students without learning disabilities progress to higher academic level, they report using fewer compensation strategies. The effect of academic level on GPA was partially mediated by the three self-

regulated learning factors. In contrast to the LD group, SAT-Verbal had a positive effect on GPA for students without LD (ß = .245). SAT-Verbal had a large negative path to compensation strategies (ß = -.505) suggesting that students with higher SAT-Verbal reported using fewer compensation strategies. There was no relationship between SAT-Verbal and the routine memorization factor. The effect of SAT-Verbal on GPA was mediated by conceptual skills and compensation strategies. As in the model for students with LD, SAT-Math was unrelated to all variables in the model except GPA (ß = .272). The total effect of SAT-Verbal on GPA was .394. The total effect of academic level on GPA was .328.

<Fig. 3 here>

Structural Model for Students with Learning Disabilities

As indicated above, because of the difficulty with establishing factorial invariance for the Motivation variable in the LD sample this variable was omitted from the final analysis. In the structural model for students with learning disabilities, exogenous variables academic level, SAT-Verbal, and SAT-Math had direct and indirect paths to GPA via the three self-regulated learning factors (see Figure 4). The structural equation model for students with learning disabilities accounted for 35% of the variance in their self-reported GPAs. In the sample of students with learning disabilities, the largest path from the conceptual skills factor led directly to GPA (ß = .597). This suggests that after controlling for the other variables in the model, students with learning disabilities who scored higher on the conceptual skills factor also reported having higher GPA's. The direct paths from routine memorization and compensation strategies to GPA were also significant (ß = .274 and ß = .114, correspondingly), which suggests that students who reported using more of these learning strategies in their academic work also reported receiving better grades.

<Fig. 4 here>

The direct path from academic level to GPA was not significant; however; academic level had an indirect effect on GPA via the three self-regulated learning factors. Older students with LD reported using more conceptual skills, and fewer routine memorization and compensation strategies. SAT-Verbal had an unexpected direct negative path to GPA (ß = -.204); finding that students with higher SAT-Verbal scores had lower GPA's was counterintuitive at first. The effect of SAT-Verbal on GPA was mediated by the conceptual skills and compensation strategies. There was no relationship between SAT-Verbal and the routine memorization factor. SAT-Math had a small positive path to GPA (ß = .110), and was unrelated to all other variables in the model. The total effect of SAT-Verbal on GPA was

.168. The total effect of academic level on GPA was .328. Global fit indices for the omnibus structural model and structural models for students with and without learning disabilities, as well as the proportion of variance in students' GPA accounted for by these models are presented in Table 3.

<Table 3 here>

Discussion

The purpose of this study was to examine the question of whether motivation for and the use of standard self-regulated learning strategies and compensation strategies provides a differential prediction of academic achievement for college students with and without learning disabilities (LD), after controlling for the effects of standardized aptitude measures (SAT) and academic level in college. To test this hypothesis, structural equation modeling procedures and multiple groups analysis were used in order to specify and test an a priori causal model. The results of this study clearly indicate that the relationships among the latent constructs in the structural equation model varied for students with and without LD, as indicated by differing standardized path coefficients in the multiple groups analysis. Because factorial invariance for the motivation factor could not be established for the LD sample, this latent variable was omitted from the multiple groups analysis, which affected the subsequent interpretations of the relationships between the remaining variables in the model, and the amount of variance explained by the collection of the pre-college and self-regulatory variables in students' cumulative GPA. Coupled with a very small sample size for students with LD (n=53), these issues presented certain limitations for the interpretation of the results.

In terms of the structural equation modeling results, the relationships between academic level, standardized aptitude measures (SAT-Verbal and SAT-Math), routine memorization, and cumulative GPA differed for students with LD and without LD. The routine memorization factor is self-explanatory in that it reflects students' ability to memorize facts, formulas, and definitions, representing a skill that may become beneficial to students in some academic situations, such as tests emphasizing routine memorization of the material. In the LD group, the negative relationship between academic level and routine memorization, coupled with positive relationship between routine memorization and GPA appeared counterintuitive at first. The routine memorization methods often comprise areas of weakness for disabled learners (Crux, 1991; McGuire, 1998; Reis et al., 2000). In fact, researchers have found that some students with LD prefer to use alternative memory techniques, such as mnemonic strategies to master and retain material and compensate for their learning difficulties (Crux, 1991). Mnemonic techniques may include methods such as associating a new concept with something familiar, creating a

meaningful acronym for recalling interrelated concepts, using a system of color coding to strengthen associations, or drawing pictures on the margins of the notes.

The results of this study indicate that the relationships among the latent constructs in the structural equation model varied for students with and without LD, as evidenced by differing standardized path coefficients in the multiple groups analysis. Whereas the three self-regulated learning factors appeared to exert small influence on academic achievement of students without LD, as indicated by the small standardized path coefficients, in the LD group conceptual skills factor clearly had a large impact on LD students' GPA. The indirect impact of SAT-Verbal on GPA via the mediating factors of conceptual skills and compensation strategies differed in the LD and the non-LD sample. In particular, the path coefficient from the conceptual skills factor to GPA for students with LD was appreciably larger (ß = .60) than for students without LD (ß = .143), indicating that the use of these self-regulated learning strategies made a larger positive difference in academic achievement of students with LD, after controlling for the other variables in the model. Conceptual skills, as measured by the *LSSS* in this study include skills, such as making inferences when reading texts, distinguishing between apparently similar ideas, and understanding challenging reading assignments, among others. These skills are traditionally valued on standardized tests and in college academic settings. Because students with LD are generally at a disadvantage because of their learning difficulties (Crux, 1991; Shin, 1998), developing and using conceptual skills in their academic work may produce a large positive difference for their grades.

These findings are supported by previous research, including a qualitative study of high ability students with LD conducted by Reis and her colleagues (2000). Reis et al. (2000) emphasized that these students attributed their success in their academic pursuits to their ability to use self-regulated learning strategies, such as study strategies and time management skills including note taking, use of daily, weekly, and monthly calendars, and identifying key points when studying written material. The positive path between compensations strategies and GPA indicated that students who reported using more compensation strategies also reported higher GPA's. Compensation strategies in this study referred to compensatory learning supports used by LD students, such as books on tape to accompany text material, computer programs to help organize written reports, use of tape recorders in class as a supplement to written notes, and spelling aids (e.g., Franklin speller). Again, the direction of the relationship between academic level, compensation strategies, and GPA was different for the LD and non-LD sample; in addition, the direction of the relationship was somewhat counterintuitive in the LD sample. Whereas in the non-LD sample both direct paths (from academic level to compensation strategies, and from compensation strategies to GPA) were negative suggesting that students in higher academic levels use

fewer compensatory methods, and that the greater use of these methods is associated with lower GPA, in the LD sample the positive path from compensation strategies to GPA suggested that the use of these methods helps students with LD boost their GPA's to a certain degree. This finding supports one of the study's hypotheses that academic self-regulation has its own idiosyncrasies when applied to students with LD. Because of their learning deficits in information processing, reading, or writing, students with LD must employ a set of compensatory techniques to help them compensate for their learning disability and succeed in a challenging college environment.

Of note is the relationship of academic level and academic achievement, which differed among the students with and without LD, with a positive relationship between these variables in the non-LD sample, and absence of any relationship in the LD sample. The data obtained in the study indicated some "upward bias" in the GPA distribution in the total sample of 470 students. One observation from the data was that juniors and seniors, on average, appeared to have higher GPAs than freshman and sophomores. One possible reason explaining this phenomenon is that, as students progress from one academic level to another, they acquire the learning skills that are necessary to succeed in college, i.e., they learn how to self-regulate their academic behaviors, particularly their use of self-regulated learning strategies and their learning orientations (Vermetten et al., 1999), and their motivation (Van Etten et al., 1999). Another reason is that some attrition in the composition of the student body occurs, as students who have the lowest GPA's either improve their academic performance to meet the university's minimum scholastic requirements, or they drop out of college. Finally, as students move from lower to higher levels in college, the grading system may become more lenient for juniors and seniors, resulting in somewhat inflated GPA's. The reason that the grading system becomes more lenient is due to the class size. In particular, because at lower academic levels class sizes are larger, the grading system is more stringent. In contrast, at higher academic levels, class sizes tend to get smaller, and the grading system tends to become more lenient. The absence of any relationship between academic level and GPA for LD students suggests that these explanations may not apply to students with learning disabilities in this study.

Some of the most intriguing differences between the LD and non-LD group occurred in the relationships among scholastic aptitude measures (SAT), self-regulated learning variables, and cumulative GPA. Historically, standardized aptitude and achievement measures such as the SAT and ACT have been used to make college admissions decisions, even though research studies have provided evidence of limited predictive validity of these measures. According to a number of leading researchers (e.g., Baron & Norman, 1992; Crouse & Trusheim, 1988; Sternberg & Williams, 1997), to believe that a

single test such as the SAT or ACT or even GRE can accurately describe one's academic potential in college does not reflect reality. SAT-Math appeared to work in a similar way in the model for students with and without LD. It had no relationship with any variables in the model except for a small positive relationship with the GPA. In the non-LD sample, the effect of this variable was larger (ß = .272) than in the LD sample (ß = .110), indicating that whereas for the non-disabled students higher scores on SAT-Math were associated with higher GPA's in college, for students with LD the relationship was so small that it was of little overall importance.

However, the relationship of SAT-Verbal with other variables in the model presented interesting differences for the LD and non-LD samples. For example, the negative path from SAT-Verbal to GPA for students with LD appeared counter-intuitive at first, given previous research findings that SAT-Verbal is a positive predictor of college GPA for students in the general population. Theoretically, taking the SAT with accommodations is intended to "level the playing filed" for students with LD, thus equalizing initial differences that students with and without LD may have. However, as indicated above, issues related to the provision of accommodation on standardized tests, such as the SAT and the ACT, and the predictive validity of such scores for students with learning disabilities is a widely debated issue in the field of learning disabilities (for an excellent review, see Pitoniak & Royer, 2001). One important explanation substantiated by the empirical evidence from large scale studies such as the ETS/CB/GREAB research project relates to the finding that the SAT scores significantly overpredict college performance for examinees with learning disabilities receiving test accommodations (e.g., Braun et al., 1998; Bennett et al., 1988). Another possible explanation relates to the nature of the LD label. Learning disabilities represent a broad label, as they represent a diverse class of learning disorders such as difficulties with information processing, memorizing material, reading, writing, or spelling (Shin, 1998). As a consequence, students with LD represent a very heterogeneous group, and generalizing group findings to an individual level may be very tenuous and, in fact, unadvisable. For instance, a student who has taken an SAT exam may have obtained a fairly high score; however, his or her learning deficits in information processing become a significant barrier to their learning, and may exert a negative impact on their grades.

Whereas SAT-Verbal had no relationship with routine memorization in either LD or non-LD group, there were interesting mediational effects of this variable on GPA via conceptual skills and compensation skills for both groups. In particular, conceptual skills mediated the relationship of SAT-Verbal with the LD students' GPA. Even though the direct effect of SAT-V on GPA was negative, the direct paths from SAT-V to conceptual skills, and from conceptual skills to GPA represented the largest

effects in the LD model. The fact that the conceptual skills factor mediated the relationship of SAT-Verbal and GPA for LD students seems perfectly logical, as the types of learning skills required to perform well on standardized tests are also traditionally valued in school settings. Compared with a fairly small effect of conceptual skills on GPA for students without LD, it appears that the use of conceptual skills makes a greater positive difference in the academic attainment of students with learning disabilities.

Another mediational effect that presented interesting differences for LD and non-LD sample involved the relationship among SAT-Verbal, compensation strategies, and GPA. Again, even though the relationship between SAT-Verbal and GPA was negative, the relationship between SAT-V and compensation strategies, as well as the relationship between compensation strategies and GPA was positive. These relationships support previous research findings indicating that because of LD students' processing difficulties and unique strengths and weaknesses, they often have to devise special study methods and resort to the use of various compensation strategies in order to ameliorate the effects of their learning disability and succeed academically (Adelman & Vogel, 1993; Barga, 1996; McGuire, 1998; Policastro, 1993; Reis et al., 2000). In other words, even though students with LD face additional obstacles in college because of their learning difficulties, with sufficient support including the instruction in self-regulated learning methods, these students succeed in postsecondary settings and graduate at the same rate (Vogel & Adelman, 1992, 1993) or even higher rate (e.g., McGuire & Madaus, 1999) than their non-disabled counterparts. In contrast, for students without learning disabilities the relationship between SAT-Verbal and compensation strategies, as well as the relationship between compensation strategies and GPA was negative. Perhaps non-disabled students did not perceive the need to resort to the use of compensation strategies because they did not face the academic challenges as students with learning disabilities did.

Previous research indicates that students with LD are a diverse population, and they represent a continuum of severity with respect to their learning disability (Hodge & Preston-Sabin, 1997), which, in turn, has implications for their use of academic self-regulatory methods. Some students have a very severe learning disability, which may necessitate the use of a greater repertoire of special coping or compensatory strategies. Conversely, students with a less severe LD may need to use only a few compensation strategies to help them succeed in academic settings. Vogel and Adelman (1992) proposed that intellectual functioning and language abilities, as well as the aptitude-achievement discrepancy of students with LD are indicators of the severity of LD, which, in turn, influences educational, occupational, and academic achievement levels in adulthood. In this study, the extent of the severity and

etiology of learning disabilities in the sample of students with LD was not examined, thus limiting conclusions about the possible impact of the severity and nature of the learning disability on students' self-regulated functioning and academic performance.

The results of this study may also be influenced by the nature of the compensation strategies factor. Researchers in the field of learning disabilities provide different definitions for compensation strategies. For example, Crux (1991) defined compensation strategies to include study strategies, cognitive strategies (also called learning strategies), compensatory supports (e.g., tape recorders and computer word processing programs), and environmental accommodations such as test-taking accommodations (e.g., extended test time, less distracting test-taking setting). In this study, the compensation strategies factor included strategies that could be more appropriately referred to as "compensatory supports" in Crux's conceptualization (see also Raskind and Scott, 1993). Students with a higher score on compensation strategies reported greater use of such technology supports such as tape recorders to accompany text material, voice output, or screen readers to help understand written material, and visual, graphic organizer computer programs to help organize written reports, among other strategies. Future studies should examine the impact of a larger repertoire of compensation strategies on the academic achievement of students with learning disabilities.

Limitations

This study provided valuable information concerning the differential impact of the use of standardized aptitude measures and academic self-regulatory methods on academic achievement among university students with and without learning disabilities. However, findings from this investigation need to be viewed in light of several limitations. First, students were asked to provide a self-report of their use of self-regulatory methods across academic contexts. Some researchers argue that students' self-regulated learning strategy use should be studied with reference to a specific course and timeframe (e.g., Bol, Warkentin, Nunnery, & O'Connell, 1999). Second, self-reported GPAs were used in the analyses. The correlation between students' self-reported and actual GPAs that were obtained from the Registrar's office was very high ($r = .95$), thus reducing concerns about the reliability of student self-report. The rationale for using students' self-reported GPAs instead of their actual GPAs was because of the sample size.

Because of the realities of collecting data in authentic settings, very unequal sample sizes existed for students with and without LD. Recruiting participants with LD posed several challenges. The sample was limited to students who were receiving services from a comprehensive support program for college

students with learning disabilities. The willingness of these students to participate in studies such as this is often constrained by their need to invest a great deal of time in their studies (J. McGuire, personal communication, September 15, 2001). Their priority with respect to allocation of time was academically focused and precluded voluntary participation. In addition, because the sample of students with LD was so small, the statistical tests did not possess enough power to effectively test for the invariance of paths across the models for students with and without LD. This precluded generating stronger conclusions about the ways in which students with and without learning disabilities differ on these factors. The observed differences in the postulated causal models may have capitalized on the small sample size of students with LD, which could make cross-validation of these results difficult. In addition, because the factorial invariance could not be established for the motivation variable in the LD sample, this variable had to be dropped from the final model in the multiple groups analysis. This explains why the percentage of variance explained by the model in student GPA was much higher for the omnibus run that included that variable (61%) as compared to the multiple groups run for the LD and non-LD sample where the percentage of variance was only 35% and 38%, correspondingly. Overall, these findings should be viewed with caution as this is an exploratory study.

Conclusions

The results of this study indicate that students with LD differed significantly from students without LD in the relationships between standardized aptitude measures, academic level, and the use of self-regulated learning and compensation strategies, which, in turn, provided a differential explanation of academic achievement for these groups of students. Numerous research findings converge to forge the conclusion that successful students must develop effective study strategies and methods. As Hodge and Preston-Sabin (1997) argued, the admonition to study harder in order to succeed academically presents barriers for students who have not developed an effective reading system, do not understand the importance of good notes, do not know how to organize their study time, or do not know how to approach test taking situations in an effective manner. Results of this study contribute to the knowledge base about academic self-regulation of postsecondary students with LD, and may provide additional insights about the differential impact of the standardized aptitude measures and the use of self-regulated learning strategies and compensation strategies among students with and without LD. The need for effective instruction in academic self-regulatory methods for college students with LD has been affirmed in the research on the strategies they use (Barga, 1996; Butler, 1998; Butler et al, 2000; Bursuck & Jayanthi, 1993; McGuire, Hall, & Litt, 1991). Problems students with learning disabilities experience in

learning, as well as their deficiencies in academic self-regulation may carry over from secondary to postsecondary settings, having the potential to affect every area of postsecondary education (Gerber & Reiff, 1994).

This study provides a link to previous findings emphasizing that standardized aptitude and achievement measures such as the SAT and the ACT have limited predictive power for predicting students' academic achievement in college. It should be noted that standardized tests are only static measures of students' ability to perform an academic task in a particular point in time. Assessments of students' need to better identify the building blocks of effective, self-regulated learners, so that more students are given opportunities for higher education, particularly students with learning disabilities who are often at an disadvantage because of their learning difficulties. Learners are actively processing information and adapting to their environment, and measurement of the variables that enhance and facilitate learning may be more effective indicators of future success (Reiff et al., 2001; Sternberg & Williams, 1997). Until recently, the research investigating the psychometric properties of traditional standardized measures has been much more extensive than research examining models of learning that include non-cognitive variables. As this and other study indicate (Baron & Norman, 1993; Naumann, 1998; Pintrich, 1989) that non-cognitive variables provide additional information about students' academic attainment above and beyond standardized measures of student aptitude.

Importantly, the findings in this study that academic self-regulation has its own idiosyncrasies when applied to students with LD and that there is a differential impact of standard and compensatory self-regulation methods on students' GPA provide important implications for programming at the college level (Pintrich, Anderman, & Klobukar, 1994). Support programs for college students with LD typically focus directly on academic issues such as providing accommodations in the form of extended time on tests, notetakers, separate testing locations, and training in study skills and time management (Reiff et al., 2001). Perhaps additional emphasis should be placed on methods to increase the awareness and enhance the academic self-regulation of these students. In particular, service providers can assist students with LD to reframe their disability in a positive sense, not associate the expenditure of extra time and effort in the use of compensation strategies with a negative stigma, and become independent learners by encouraging them to construct personalized strategies that meet their individual needs. Research suggests that academic self-regulation is an alterable variable (Barga, 1996; Butler, 1998; Pintrich, 1995; Zimmerman & Bandura, 1994). Students with LD, with appropriate encouragement and scaffolding, have the opportunity to develop individualized academic self-regulatory methods that may

favorably impact their academic and vocational success and better prepare them for challenging employment opportunities.

Author Note

Lilia Ruban is Assistant Professor, Department of Curriculum & Instruction, , and Researcher, Consistency Management® & Cooperative Discipline Project at the University of Houston.

All correspondence regarding this paper should be addressed to: Lilia M. Ruban, University of Houston, College of Education, Department of Curriculum & Instruction, 444 Farish Hall, Houston, TX 77204-5027; Phone: (713)743-3311; FAX: (713)743-4900; e-mail: Lruban@UH.EDU.

Acknowledgements

This manuscript is based in part on a dissertation submitted in partial completion of the requirements for a doctoral degree in the Neag Graduate School of Education at the University of Connecticut. I want to thank the members of my doctoral Committee, including Sally Reis, Joseph Renzulli, Joan McGuire, Robert Gable, and David Kenny for their help and feedback during the completion of this research.

References

Adelman, P. B., & Vogel, S. A. (1992). The success of college students with learning disabilities: Factors related to educational attainment. *Journal of Learning Disabilities, 25* (7), 430-441.

Adelman, P. B., & Vogel, S. A. (1993). Issues in program evaluation. In S. A. Vogel & P. B. Adelman (Eds.), *Success for college students with learning disabilities* (pp. 323-343). New York: Springer-Verlag.

Alexander, P. A., & Judy, J. E. (1988). The interactions of domain-specific and strategic knowledge in academic performance. *Review of Educational Research, 58*, 375-404.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Barga, N. K. (1996). Students with learning disabilities in education: Managing a disability. *Journal of Learning Disabilities, 29*(4), 413-421.

Barron, J., & Norman, F. (1992). SATs, achievement tests, and high-school class rank as predictors of college performance. *Educational and Psychological Measurement, 52*, 1047-1055.

Bennett, R. E., Ragosta, M., & Stricker, L. J. (1988). Test results. In W. Willingham, M. Ragosta, R. A. Bennett, H. Braun, D. A. Rock, & D. E. Powers (Eds.), *Testing handicapped people* (pp. 83-97). Boston: Allyn & Bacon.

Bentler, P. M., & Wu, E. J. (1995). *EQS for Windows: Users' Guide.* Encino, CA: Multivariate Software.

Bol, L., Warkentin, R. W., Nunnery, J. A., & O'Connell, A. A. (1999). College students' study activities and their relationship to study context, reference course, and achievement. *College Student Journal, 33*(4), 608-622.

Brinckerhoff, L. C., McGuire, J. M., & Shaw, S. F. (2002). *Postsecondary education and transition for students with learning disabilities* (2nd ed.). Austin, TX: PRO-ED.

Braun, H., Ragosta, M., & Kaplan, B. A. (1988). Predictive validity. In W. Willingham, M Ragosta, R. A. Bennett, H. Braun, D. A. Rock, & D. E. Powers (Eds.), *Testing handicapped people* (pp. 109-132). Boston: Allyn & Bacon.

Butler, D. L. (1998). A strategic content learning approach to promoting self-regulated learning by students with learning disabilities. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 160-183). New York: Guilford Press.

Butler, D. L., Elaschuk, C. L., & Poole, S. (2000). Promoting strategic writing by postsecondary students with learning disabilities: A report of three case studies. *Learning Disability Quarterly, 23*(3), 196-213.

Camara, W. F. (1998). *Effects of extended time on score growth for students with learning disabilities.* New York: College Board.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd Ed.). Hillsdale, NJ: Lawrence Erlbaum.

Crouse, J., & Trusheim, D. (1988). *The case against the SAT.* Chicago, IL: University of Chicago Press.

Crux, S. C. (1991). *Learning strategies for adults: Compensations for learning disabilities.* Middletown, OH: Wall & Emerson.

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion, 6,* 169-200.

Gable, R. K., & Wolf, M. (1993). *Instrument development in the affective domain: Measuring attitudes and values in corporate and school settings* (2nd ed.). Norwell, MA: Kluwer Academic Publishers.

Garner, R. (1990). When children and adults do not use learning strategies. *Review of Educational Research, 60,* 517-530.

Geisinger, K. F. (1994). Psychometric issues in testing students with disabilities. *Applied Measurement in Education, 7,* 121-140.

Gerber, P. J., & Reiff, H. B. (1994). *Learning disabilities in adulthood: Persisting problems and evolving issues.* Boston, MA: Andover.

Gresham, F. M., MacMillan, D. L., & Bocian, K. M. (1996). Learning disabilities, low achievement, and mild mental retardation: More alike than different? *Journal of Learning Disabilities, 29,* 570-581.

Harvard Law Review Association. (1998). Toward reasonable equality: Accommodating learning disabilities under the Americans with Disabilities Act. *Harvard Law Review, 111,* 1560-1577.

Henderson, C. (1999). *College freshmen with disabilities.* Washington, DC: American Council on Education, HEATH Resource Center.

Hodge, B. M., & Preston-Sabin, J. (Eds.). (1997). *Accommodations - or just good teaching? Strategies for teaching college students with disabilities.* Westport, CT: Praeger.

Individuals with Disabilities Educational Act of 1991, 20 U.S.C. § 1400 *et seq.*

Individuals with Disabilities Educational Act of 1997, 20 U.S.C. 1412(a) (17)(A).

Kenny, D. A., Kashy, D. A., & Bolger, N. (1998). Data analysis in social psychology. In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology (vol. 1, 4th ed., pp. 233-265).* Boston, MA: McGraw-Hill.

Kline, R. B. (1998). *Principles and practice of structural equation modeling.* New York: Guilford.

Light, R. J., Singer, J. D., & Willett, J. B. (1990). *By design: Planning research on a higher education.* Cambridge, MA: Harvard University Press.

Linn, R. L. (1990). Admissions testing: Recommended uses, validity, differential prediction, and coaching. *Applied Measurement in Education, 3,* 297-318.

Lonka, K., & Lindblom-Ylänne, S. (1996). Epistemologies, conceptions of learning, and study practices in medicine and psychology. *Higher Education, 31,* 5-24.

Marsch, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indices in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin, 103,* 391-410.

Maruyama, G. M. (1998). *Basics of structural equation modeling.* Thousand Oaks, CA: Sage.

McGuire, J. M. (1998). Educational accommodations: A university administrator's view. In M. Gordon & S. Keiser (Eds.), *Accommodations in higher education under the Americans with Disabilities Act (ADA)* (pp. 20-45). New York: Guilford Press.

McGuire, J. M., Hall, D., & Litt, V. A. (1991). A field based study of the direct service needs of college students with learning disabilities. *Journal of College Student Development, 32,* 101-108.

Menges, R. J., & Swinicki, M. D. (1995). From the series editors. In P. R. Piintrich (Ed.), *Understanding self-regulated learning* (Vol. 63, p. iii). San-Francisco, CA: Jossey-Bass.

Naumann, W. C. (1998). *Predicting first-semester grade point average using self-regulated learning variables.* Unpublished doctoral dissertation, the University of Nebraska, Lincoln.

Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, A. W., Brody, N., Ceci, S. J., Halpern, D. F., Loelin, J. C., Perloff, R., Sternberg, R. J., & Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist, 51*(2), 77-101.

Nolen, S. B., & Flaladyna, T. M. (1990). Personal and environmental influences on students' beliefs about effective study strategies. *Contemporary Educational Psychology, 15,* 116-130.

Pintrich, P. R. (1989). The dynamic interplay of student motivation and cognition in the college classroom. *Advances in Motivation and Achievement, 6,* 117-160.

Pintrich, P. R. (1995). Understanding self-regulated learning. In R. J. Menges & M. D. Svinicki. (Eds.), *New directions for teaching and learning* (vol. 63, pp. 3-12). San Francisco, CA: Jossey-Bass.

Pintrich, P. R., Anderman, E. M., & Klobukar, C. (1994). Intraindividual differences in motovation and cognition in students with and without learning disabilities. *Journal of Learning Disabilities, 27,* 360-370.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82,* 33-40.

Pintrich, P. R., & Garcia, T. (1991). Students' goal orientation and self-regulation in the college classroom. *Advances in Motivation and Achievement, 7,* 371-402.

Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom tasks. In D. Schunk & J. Meece (Eds.), *Student perceptions in the classroom: Causes and consequences* (pp. 149-183). Hillsdale, NJ: Erlbaum.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the *Motivated Strategies for Learning Questionnaire* (MSLQ). *Educational and Psychological Measurement, 53,* 801-803.

Pitoniak, M. J., & Royer, J. M. (2001). Testing accommodations for examinees with disabilities: A review of psychometric, legal, and social policy issues. *Review of Educational Research, 71*(1), 53-104.

Phillips, S. E. (1994). High-stakes testing accommodations: Validity versus disabled rights. *Applied Mesurement in Education, 7,* 93-120.

Bursuck, W. D., & Jayanthi, M. (1993). Strategy instruction: Programming for independent study skills usage. In S. A. Vogel & P. A. Adelman (eds.), *Success for college students with learning disabilities* 177-206). Boston, MA: Spronger-Verlag.

Pressley, M. & McGormick, C. B. (1995). *Advanced educational psychology for educators, researchers, and policymakers.* New York: Harper-Collins.

Reiff, H. B., Hatzes, N. M., Bramel, M. H., & Gibbon, T. (2001). The relation of LD and gender with emotional intelligence in college students. *Journal of Learning Disabilities, 34*(1), 66-78.

Reis, S. M., McGuire, J. M., & Neu, T. W. (2000). Compensation strategies used by high ability students with learning disabilities. *Gifted Child Quarterly, 44*(2), 123-134.

Reis, S. M., Neu, T. W., & McGuire, J. M. (1997). Case studies of high ability students with learning disabilities who have achieved. *Exceptional Children, 63*(4), 463-479.

Ruban, L. M. (2000). Patterns of self-regulated learning and academic achievement among university students with and without learning disabilities (Doctoral Dissertation, University of Connecticut, 2000). *Dissertation Abstracts International* (UMI No. TX 5-179-576).

Ruban, L. M., & Reis, S. M. (1999). *Learning Strategies and Study Skills survey.* Unpublished instrument, Storrs, University of Connecticut.

Schunk, D. H., & Zimmerman, B. J. (1994) (Eds.). *Self-regulation of learning and performance: Issues and Educational implications.* New York: Guilford.

Shin, L. M. (Ed.) (1998). *Learning disabilities sourcebook* (vol. 33). Detroit, MI: Omnigraphics.

Sternberg, R. J., & Williams, W. M. (1997). Does the Graduate Record Examination predict meaningful success in the graduate training of psychologists? A case study. *American Psychologist, 52,* 630-641.

Student Support Services (SSS). (1992). Written materials regarding characteristics of learning disabled students and programs available through SSS, University of Idaho, Moscow, Idaho.

Sutarso, T., Baggert, L. K., Sutarso, P., & Tapia, M. (1996, November). *Effect of gender and GPA on emotional intelligence.* Paper presented at the annual meeting of the Mid-South Educational Research Association, Tuscaloosa, AL.

Van Etten, S., Pressley, M., & Freebern, G. (1999). *College seniors' theory of their academic motivation.* Paper presented at the annual meeting of the American Psychological Association, Boston, Masachussetts.

Vermetten, Y. J., Vermunt, J. D., & Lodewijks., H. G. (1999). A longitudinal perspective on learning strategies in higher education: Different viewpoints towards development. *British Journal of Educational Psychology, 69,* 221-242.

Vogel, S. A., & Adelman, P. B. (1992). The success of college students with learning Disabilities: Factors related to educational attainment. *Journal of Learning Disabilities, 25*(7), 430-441.

Vogel, S. A., & Adelman, P. B. (1993). *Success for college students with learning disabilities.* New York: Springer-Verlag.

Watkins, D., & Hattie, J. (1985). A longitudinal study of the approaches to learning of Australian tertiary students. *Human Learning, 4,* 127-141.

Weinstein, C. E., Zimmerman, S., & Palmer, D. (1988). Assessing learning strategies: The design and development of the LASSI. In C. E. Weinstein, E. T. Goetz, & P. A. Alexander (Eds.), *Learning and study strategies: Issues in assessment, instruction, and evaluation* (pp. 25-40). Boston, MA: Academic Press.

Wightman, L. F. (1993). *Test takers with disabilities: A summary of data from special administrations of the LSAT* (Research Report 93-03). Newtown, PA: Law School admission Council.

Wilson, K. M. (1983). *A review of research on the prediction of academic performance*

after the freshmen year. (College Board Report No. 83-2). New York: College Entrance Examination Board.

Wolters, C. A. (1998). Self-regulated learning and college students' regulation of motivation. *Journal of Educational Psychology, 90*(2), 224-235.

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81,* 329-339.

Zimmerman, B. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist, 25,* 3-17.

Zimmerman, B. J. (1998). Academic studying and the development of personal skill: A self-regulatory perspective. *Educational Psychologist, 33*(2/3), 73-86.

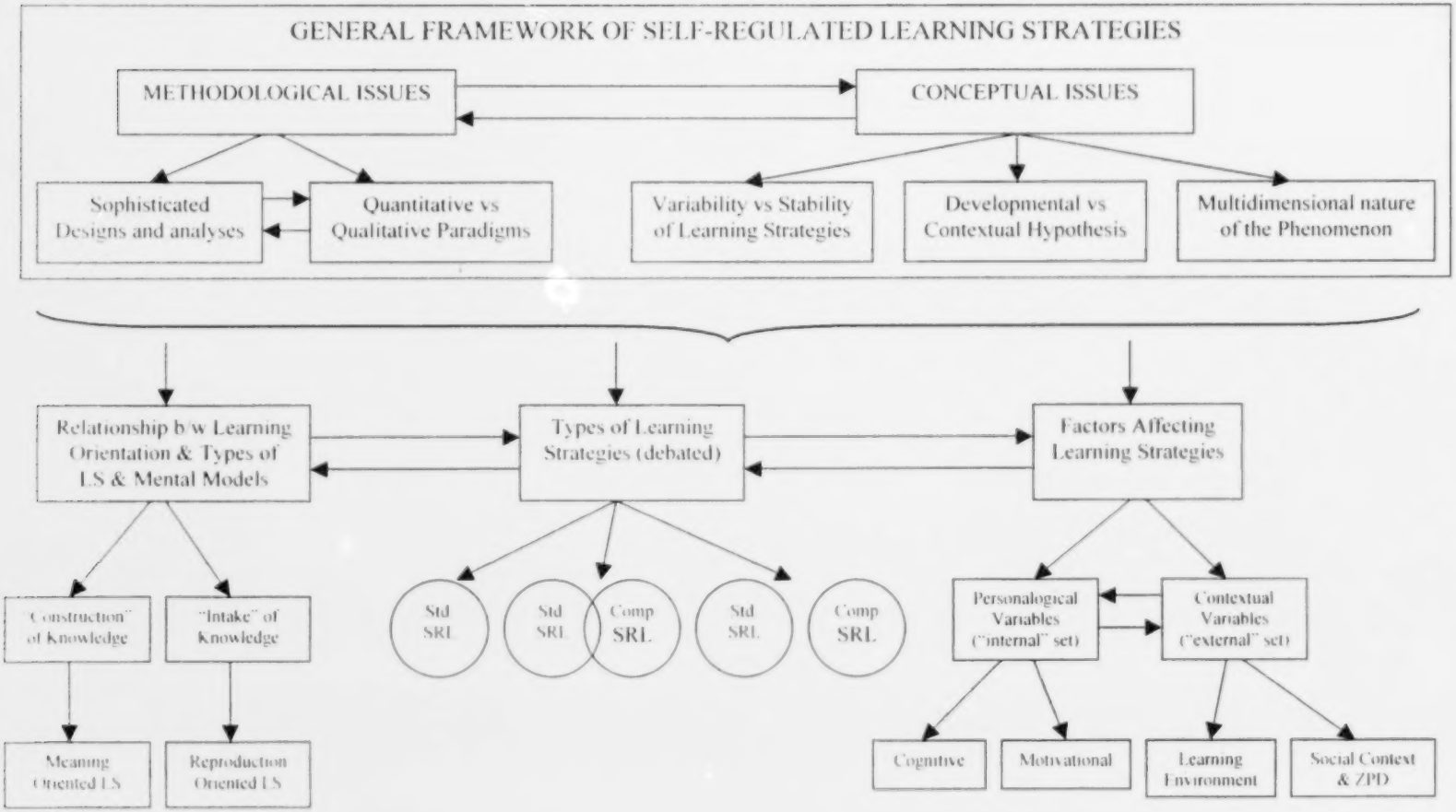
Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on attainment in a writing course. *American Educational Research Journal, 29,* 845-862.

Zimmerman, B. J., & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal, 23,* 614-628.

Zimmerman, B., & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self-regulated learning. *Journal of Educational Psychology, 80*(3), 284-290.

Zimmerman, B. J., & Paulsen, A. S. (1995). Self-monitoring during collegiate studying: An invaluable tool for academic self-regulation. In P. R. Pintrich (Ed.), *Understanding self-regulated learning* (pp. 13-28). San Francisco, CA: Jossey-Bass.

Figure 1. Concept Map of Self-Regulated Learning (SRL) Strategies Within The General Framework of Methodological and Conceptual Issues (Ruban, 2000)



Note. SRL = Self Regulated Learning; LS = Learning Strategies; Std. SRL = Standard Learning Strategies; Comp. SRL = Compensation Self Regulated Learning Strategies; ZPD = Zone of Proximal Development

Table 1

Demographic, academic and aptitude characteristics of the university students with and without learning disabilities (N=470).

Category	Students without LD (n=417)	Students with LD (n=53)
Gender	%	%
Male	30.5	58.5
Female	69.5	41.5
Mean Age	19.9	21.7
Std. Dev.	1.1	2.2
Ethnicity	%	%
Caucasian	75.5	88.7
Asian	8.1	2.3
Hispanic or Puerto-Rican	6.0	5.7
Black	4.3	2.3
Not Reported	5.0	3.3
Academic Level	%	%
Freshman	23.3	34.0
Sophomore	29.7	26.4
Juniors	30.7	9.4
Seniors	16.1	29.4
GPA Range	.42 – 4.00	1.70 – 3.80
GPA Mean	3.03	2.77
Std. Dev.	.83	.58
SAT-V Range	370 – 800	340 - 640
SAT-V Mean	604.52	503.41
Std. Dev.	98.35	70.98
SAT-M Range	330 – 800	200 - 690
SAT-M Mean	606.68	542.77
Std. Dev.	97.29	93.40

Table 2

Students' unadjusted mean scores on the self-regulated learning factors, type of learning strategies comprising the self-regulated learning factors, Cronbach alpha reliabilities, and goodness of fit summary indices.

Predictor Variables	Students without LD (N=417)		Students with LD (N=53)		Type of Learning Strategies		Cronbach Alpha Reliability
	Mean	SD	Mean	SD			
Conceptual Skills[a]	3.68	.60	3.22	.66	Standard		.85
Routine Memorization[a]	3.39	.88	2.84	1.01	Standard		.81
Compensation Strategies[a]	1.37	.49	1.85	.76	Compensation		.70
Goodness of Fit Summary	χ^2	df	χ^2/df	TLI	CFI	RMSEA	Conf. Interval RMSEA
	241.0*	147	1.6	.95	.96	0.037	0.033 – 0.046

Note. N = 470.

[a] Continuous variables: Mean scale scores were calculated for the three factors on the LSSS survey using a 5-point Likert scale ("1" = "*Not at all Typical of Me*;" to "5" = "*Very Typical of Me*").

* p < .001.

Table 3

Summary of global fit indices for structural models and proportion of variance in students' GPA accounted for by the models.

Model	χ^2	df	TLI	CFI	RMSEA	R^2
Entire sample[a]	491.698*	262	.92	.93	0.045	61%
Model for students with learning disabilities[b]	735.574*	440	.89	.91	0.040	35%
Model for students without learning disabilities[c]	735.574*	440	.89	.91	0.040	38%

Note. The omnibus run included latent variable Motivation that was omitted from the multiple groups analysis because factorial invariance for the motivation factor could not be established for the LD sample. This issue affected the percentage of the variance in GPA explained by the models, as well as the interpretation of the magnitude and direction of the standardized path coefficients.

[a] N = 470.

[b] n = 53.

[c] n = 417.

* $p < .001$.

Figure Captions

Figure 2. Omnibus Run: Structural model for the entire sample of university students (N = 470). The model represents relationships among the constructs of standardized aptitude measures, academic level in college, motivation, self-regulated learning variables, and academic achievement.

Figure 3. Structural model for students with learning disabilities (n=53). The model represents relationships among the constructs of standardized aptitude measures, academic level in college, self-regulated learning variables, and academic achievement. All structural parameters were significant and are represented in standard deviation units.

Figure 4. Maximum likelihood estimates for structural parameters of the model for students without learning disabilities (n=417). The model represents relationships among the constructs of standardized aptitude measures, academic level in college, self-regulated learning variables, and academic achievement. All structural parameters were significant and are represented in standard deviation units.

Figure 2. Omnibus Run: Structural model for the entire sample if university students (n = 470). The model represents relationships among the constructs of standardized aptitude measures, academic level in college, motivation, self-regulated learning variables, and academic achievement.

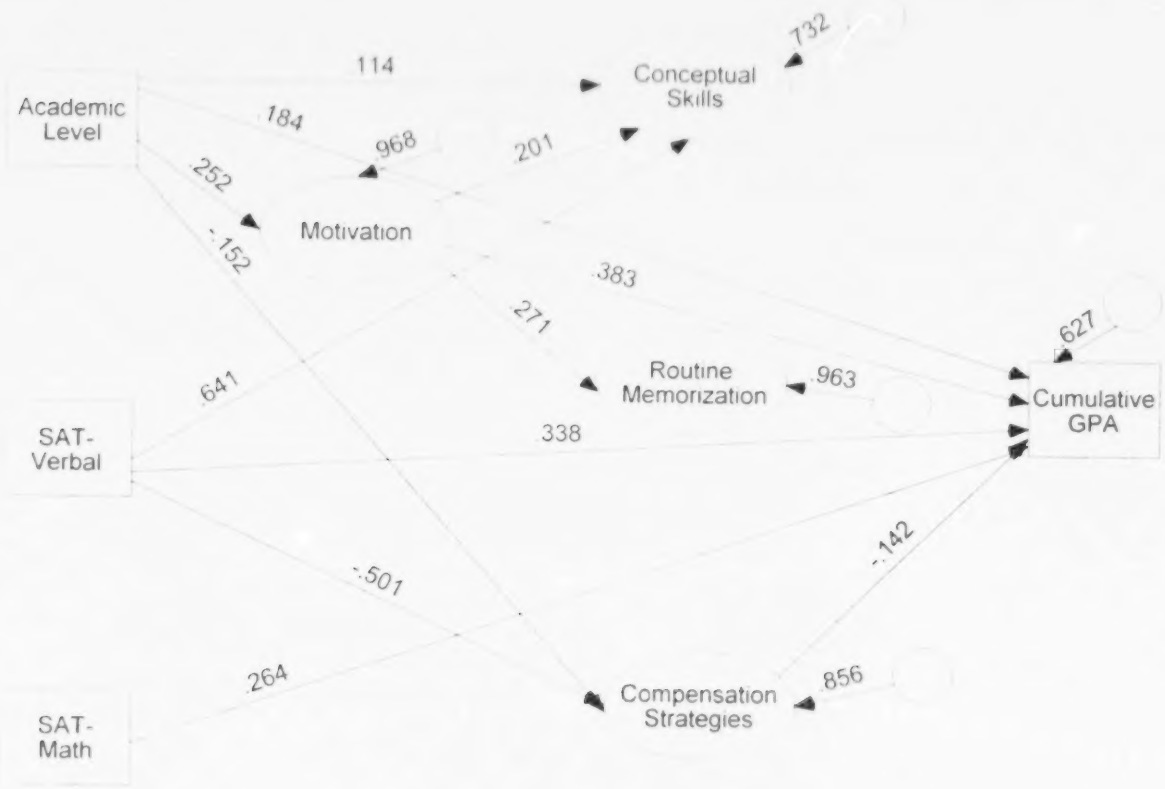


Figure 3. Structural model for students without learning disabilities (n = 417)

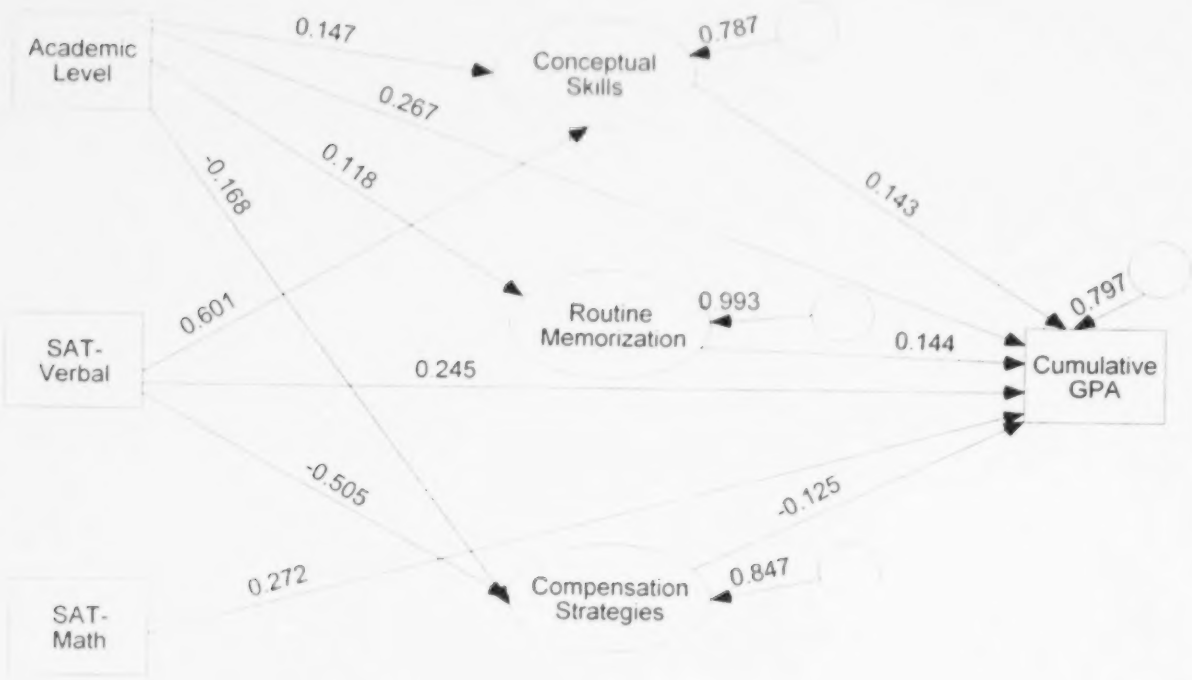


Figure 4 Structural model for students with learning disabilities (n = 53)